

### III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

#### A. IMPACT ON SOILS AND VEGETATION

Several elements of the plan will directly reduce existing impacts on the soils and vegetation of the river corridor. The portion of the riparian community most affected by camping and mooring boats are the dam-dependent Zones 3 and 4. Zone 3 contains short-lived invasion of species such as red brome, tansy mustard, fescue, Russian thistle, and camelthorn. Zone 4 is composed mainly of saltcedar, arrowweed, coyote willow, and many herbaceous plants. Zones 1 and 2 are affected by off-river use (hiking, attraction sites) and represent the original pre-dam communities (desert and woody vegetation). Refer to Section II. C. and H. for the description of soils and vegetation and to Section II. H. for visitor use activities.

Until recently, both beach soils and vegetation had been severely damaged by the practice of digging waste disposal holes. Twenty tons of human fecal material were buried in the beach sands annually, requiring 5,000 disposal holes on less than 100 beaches. Each dumpsite contributed to further destruction of the soil profile and the microbiology of the beaches. Vegetation was trampled or uprooted, and disturbance of the soil profile inhibited natural germination processes. The practice of burning toilet paper had resulted in brush fires, which caused accelerated erosion on unstable slopes.

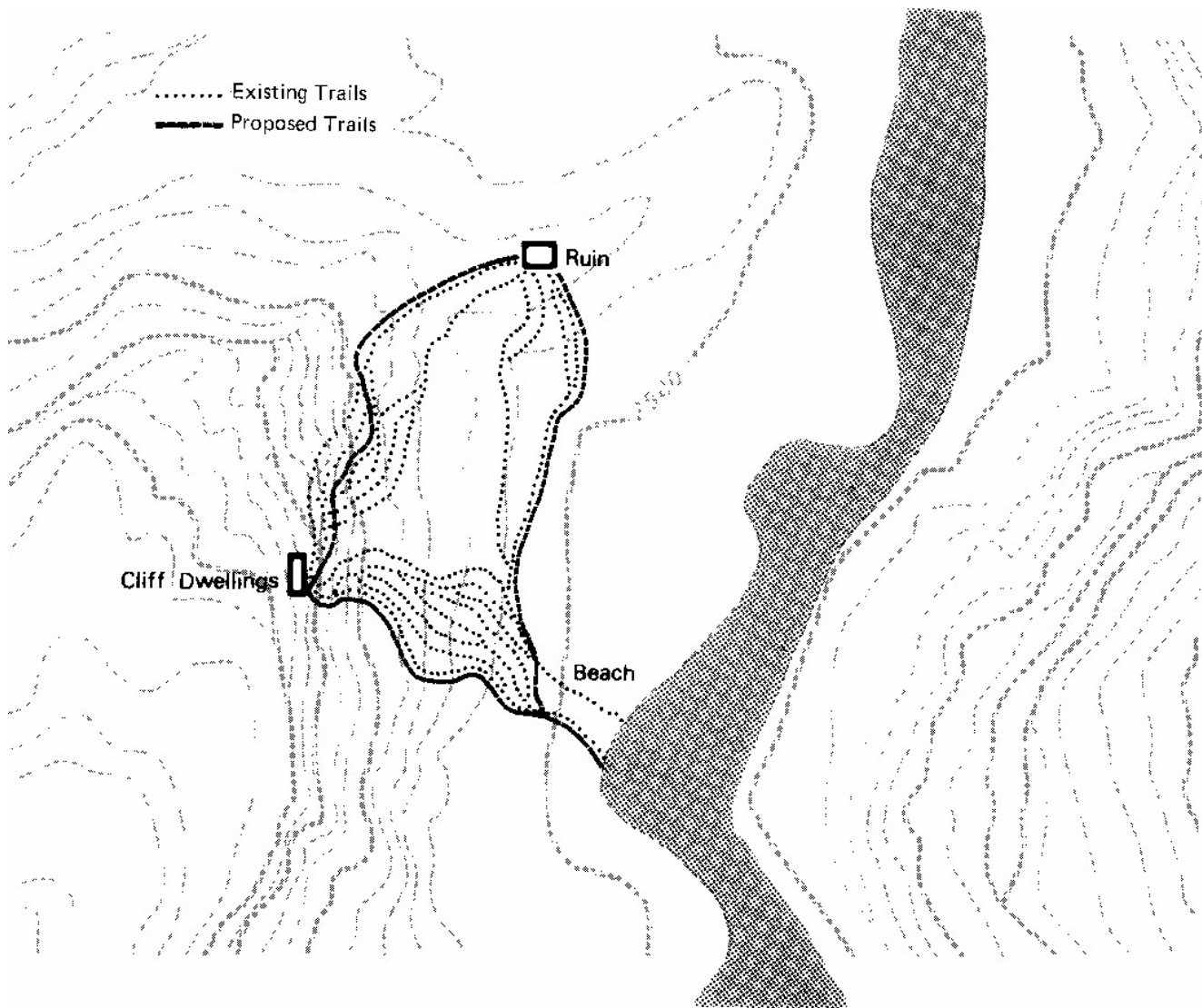
The proposal to require all river runners to haul out solid human wastes was implemented in 1978. This requirement has already significantly improved cleanliness of the beaches. The digging activities and subsequent soil and vegetation disturbance on some 250 acres of beaches has been halted. The deposition of human wastes on beaches has been reduced to occasional itinerant cases of people who refuse to adhere to the requirements. The haul out system is not fully effective since the units are not set up at lunch stops and attraction sites. This impact is fairly minimal and will be the point of further experimentation with methods and procedures to resolve the situation. Natural decomposition and cleansing processes of the river ecosystem will require several years to restore beach areas to an acceptable condition that have been impacted by past burial activities. The past use of wood fires for warmth, cooking, and recreation and the practice of collecting driftwood have contributed to soil and vegetation disturbance. Charcoal and ash have been incorporated into beaches at rates that exceed the purging capacities of the river systems. The disposal of waste charcoal and ash in the main current of the Colorado River causes further deterioration of beach soils. The charcoal residue is carried downstream to the next beach area, where it is re-deposited on the beach face and transported by wind onto campsites.

The gathering of wood for fires has in some parts of the canyon led to the denuding of standing trees both alive and dead. Driftwood is a byproduct of vegetative growth that originates primarily outside the Grand Canyon. From the late 1960's through mid-1970<sup>1</sup>s, there was a sharp decline in the available driftwood supply. Use of driftwood during that time exceeded the capacity of the system to replenish itself.

The proposal to eliminate wood fires (except for those built with imported firewood for esthetic purposes and supplemental cooking), and driftwood collecting during the summer season (April 1st to September 31st) and the requirement to haul out charcoal and ash was implemented in the 1978 season. The amount of charcoal and ash incorporated into beach sands was perceptibly reduced in the 1978 season and is expected to be minimal in the future. Wood fires will be allowed from October 1st to March 31st using natural driftwood supplies, with the requirement to haul out residue charcoal and ash. It is expected that the incorporation of charcoal and ash into beach sands during the winter season will be reduced to an acceptable level with the requirement that these materials be hauled out. Reducing the use of fires will allow natural replenishment of driftwood which should meet the demand for firewood during the winter river-running season. Minor soil and vegetation impacts will continue due to minor spillage of charcoal and ash from fire pans and failure to properly deposit and carry out fire residues. Minor trampling of soils and vegetation will occur due to driftwood collection during the winter season.

Other activities and patterns of use that result in natural resource impacts are overuse of popular beaches and crowding and congestion at attraction sites. Soils and vegetation have been severely impacted at both beach and attraction sites, due largely to foot traffic and subsequent trailing and trampling of vegetation. Soil disturbance, accelerated erosion, and changes in vegetation are apparent in heavily used areas where multiple trails, all with the same beginning and same end, are maintained by large numbers of people. For example, at Nankoweap (see following illustration), more than fifteen trails have developed between three points. Much of the native stream bank growth in the larger tributaries such as Clear Creek, Hermit Creek, Tapeats Creek, and Havasu Canyon, also shows heavy damage because of foot traffic.

The proposal to establish single trails (a total of 12.1 miles) at thirteen attraction sites will serve to delineate an appropriate walkway to each site and discourage uncontrolled access to areas of interest. The number of areas with multiple trails will be reduced and approximately 4,700 acres of disturbed soil and vegetation will be allowed to recover (see Table 24). Trail construction itself will result in short-term effects.



Some minor cut and fill will be required and ground disturbance can be expected within four feet of the trail alignments. Due to construction in sedimentary deposits and on unstable slopes minor erosion will occur. However, the rate of erosion from wind and water is expected to be far less after trail development than under present conditions. Trail alignment work was initiated in the 1978 season and has proven to be substantially successful.

Table 24  
 MULTIPLE TRAIL IMPACT AND RESTORATION  
 Estimated Acreage Improved\*\*  
 Through Trail Designation

Existing*	Approximate	
<u>Disturbance</u>	Acreage	or Construction
South Canyon	160	75
Saddle Canyon	1200	300
Nankoweap	1000	600
Little Colorado	200	50
Cardenas Creek	320	160
Unkar	1200	700
Hermit Creek	1200	600
Shinumo Creek	1200	300
Elves Chasm	640	160
Stone Creek	640	160
Tapeats Creek	1000	550
Deer Creek	640	350
Havasupai	<u>1200</u>	<u>700</u>
Total	10,600	4,705

\* Existing disturbance encompasses both direct impact and radiating effects within a given area. Direct impact (multiple trails, gullying, erosion, compaction) affects approximately 25 to 40 percent of each area. Marginal impact entails occasional trailing, soil disturbance, and vegetation damage. Some areas, such as Nankoweap, contain beaches, ridge overlooks, cultural sites and tributary streams, which are included in total acreage of disturbance.

\*\* It is estimated that 25 to 60 percent of each site will be improved through trail construction. Until trail designs are developed and recovery rates monitored, exact acreage for restored areas cannot be given.

Other actions that will indirectly serve to prevent further visitor impact at beach and attraction sites involve daily, weekly and seasonal scheduling, as well as the more uniform rate of travel through the canyon due to the elimination of motors. At present, more than 150 persons per day and as many as 940 per week leave Lees Ferry. Trip length through the canyon varies from 5 to 11 days by motor and from 12 to 18 days by oar power. The uneven dispersal of use and varying rates of travel, especially during the months of May, June, July, and August, cause overuse of certain beaches, and crowding and high density at attraction sites.

Proposed scheduling of trips will reduce the total number of persons leaving Lees Ferry per day by 50 percent. Use will be more uniformly dispersed throughout the summer season and extended into the winter season. With fewer people on the river at any given time, the probability of congestion and crowding at attraction sites will be reduced, thereby alleviating resource impacts.

Beach use will also be more evenly dispersed throughout the season which will eliminate the heavy three-month impact.

It is probable that the most heavily used beaches will continue to be the most popular throughout the year, and soils and vegetation will continue to receive impact. Furthermore, the longer trips require each person to camp more nights in the canyon. This, coupled with the proposed increase in user days (from 122,600 to 209,150) will increase beach use. However, oar trips generally carry fewer persons per party than do motor trips, 24 persons as opposed to 30 persons. With fewer people camping per night at each beach and total use spread more evenly throughout the canyon, overall resource impacts per beach are expected to be less than at present. Rotation, restriction, or scheduling of campable beach areas will not be attempted unless future monitoring indicates an impact level that is unacceptable.

The increased allocation to noncommercial users (from 7,600 to 54,450 user days) may result in greater impact on beach and off-river resources. Although there is no concrete evidence, it has been suggested that noncommercial river runners may be more damaging to the natural resources than commercial parties despite the fact that the noncommercial people were more knowledgeable about natural features and geography in the canyon at the end of a trip. This observation is generally shared by researchers (Carothers and Aitchison, 1976) and National Park Service patrol personnel. This is not to say that noncommercial river runners cause all the damage, but that they may be less inclined to follow the requirements or less knowledgeable of the special techniques for protection of the natural resources. Adverse impacts could include soil and vegetation disturbance caused by using or creating multiple trails, burial of garbage of human waste, and improper use of fires.

The above probable effects, however, are expected to be reduced under the proposed plan. All noncommercial river trip leaders will be required to have adequate knowledge of the regulations and to attend an education orientation program before running the river. All noncommercial river runners will be afforded the opportunity to gain the knowledge necessary to prevent resource damage. The possibility that commercial or noncommercial river runners may inadvertently or purposely disregard resource protection measures will continue to exist to some minor degree.

The selection of concessioners at the time of permit renewal will allow park managers to consider all responses from any company desiring to operate river-running services through Grand Canyon. Companies with the proper background and knowledge in resource protection will be chosen. This will serve to aid in control of visitor patterns of use, lessening impact on natural resources.

Until very recently, the Lower Gorge section of the river has not had sufficient management attention to properly protect the resources or provide adequate visitor services. This has resulted in deterioration of natural resources, esthetic qualities, sanitation and safety. There are clear and definable differences in attitudes, equipment, experience, and resource conservation consciousness between the commercial and noncommercial river runners and lake recreationists. Clearly, the commercial river-running interests are more prepared to take proper care of the natural resources in that they are continually exposed to National Park Service resource protection indoctrination. The lake recreationists are at the opposite end of the scale. This is evidenced by the fact that below the Diamond Creek area, accumulated litter on beach areas dramatically increases. Strictly enforced and publicized regulations geared to the needs of the lake recreationists will reduce resource impacts along the lakeshore. The new plan requires all downstream river runners to have a National Park Service permit with requirements for environmental protection. This will improve the above problems considerably.

However, since the requirement to carry out all solid human wastes will not apply to lake recreationists using powerboats, unavoidable adverse impacts resulting from human waste disposal in beach areas and attraction sites would continue.

Although off-river hiking and camping is not a significant use of the lake and river in the Lower Gorge, several sites show high use. These areas include: Travertine Grotto, Spencer Canyon, Quartermaster Canyon, Bat Cave, Rampart Cave, and Emory Falls. Use impacts, such as uncontrolled foot traffic, erosion, and vandalism would continue. Misuse of these and other areas can be correlated to two main factors: lack of patrol and lack of education. Increased interpretation and education, as well as added patrols should reduce overall resource impacts to an acceptable level

The known candidate threatened or endangered plant species, for the most part, are found above the current high water line in Zones 1 and 2, and to some degree in Zone 3. Primary impacts on these species would occur through trampling related to camp activities and hiking to attraction sites. Some impact will occur to individual plants, but it is not expected to significantly affect the overall population of any species because the plants are fairly well distributed throughout the canyon.

In summary, the overall effects of the plan will significantly reduce disturbance to soils and vegetation in the riparian zones of the river corridor, and to some extent in the lake area below Separation Canyon. Direct actions, such as elimination of human waste dumpsites, the reduction in wood fires, and trail construction, will have a positive effect on 250 acres of beach area and approximately 4,700 acres of soils and vegetation at the 13 major attraction sites. Moderate visitor use impacts will continue at popular beaches and in areas of off-river camping, hiking, and special interest sites. Visitor related impacts on the resource are caused largely by existing practices, patterns, and activities rather than by the total number of persons allowed on the river (Carothers and Aitchison, 1976). Therefore, with certain practices changed or eliminated, and patterns and activities modified, the riparian ecosystems are expected to receive less impact and remain relatively unimpaired.

## B. IMPACT ON WILDLIFE

In general, no serious adverse effects on terrestrial fauna are evident under present use levels. Visitor use activities can, however, cause shifts in animal behavior patterns and populations. Actions that presently disrupt animal or fish species include intentional or unintentional feeding, improper human waste and garbage disposal, habitat destruction through trampling, pruning, or collection of vegetation, and use of soap in side streams or tributaries.

At heavily used campsites intentional feeding and improper garbage disposal encourage high concentrations of campsite scavengers such as the ringtail cat, spotted skunk, and common raven. The harvester ant has become a problem, and increases in the densities of flesh flies and blow flies has been associated with the improper disposal of fecal materials. The digging of waste disposal holes may also interfere with the normal activities of ground dwelling and burrowing animals. A reduction in lizard populations has been noted due largely to the decrease of driftwood on which lizards rely for shelter, displaying, and foraging.

Plan actions that will alleviate wildlife disruptions include proper disposal of human wastes and garbage outside the canyon, reduction of driftwood collection, increased education of all river travelers regarding wildlife, and the continued regulation against use of soap in the tributaries. The numbers of scavengers and campsite pest insects will be

reduced, and the adverse effect of digging on ground burrowing animals would be eliminated. Impacts on wildlife (especially lizards) that are associated with removal of driftwood piles, will be reduced.

Three species of endangered birds, the bald eagle, the peregrine falcon, and the brown pelican (occasional to this area) are known to utilize the Grand Canyon environs. The present use levels have no apparent effect on these birds and no adverse impacts are foreseen due to proposed use levels and allocations.

The endangered Humpback Chub, largely restricted in distribution and breeding population to the mouth of the Little Colorado River, is occasionally caught by visitors on hook and line. To protect this species, restricted use at the mouth of the Little Colorado will remain in effect. No camping or fishing will be allowed within one-half mile of the stream's confluence with the Colorado River. Although there will be increased use during the spring and fall months, no significant disturbance of wildlife populations is anticipated.

The obsolete viceroy (Limenitis archippus) is a butterfly considered for inclusion on the endangered species list. Because of its widespread distribution, this species' habitat in Grand Canyon is not considered critical or determined to be affected by these management proposals.

### C. IMPACT ON WATER QUALITY

The present use levels and patterns have minimal effect on the quality of water in the Colorado River and its associated tributaries in Grand Canyon. The existing impacts come from the production of hydrocarbons from outboard motors, seepage from human waste dumpsites, the incorporation of camp waste water, and the use of detergents.

The current use of outboard motors results in the consumption of approximately 25,000 gallons of gasoline per year during float trips on the Colorado River. Pollutants added to the river as a result of motorized travel include approximately 5,750 pounds of petroleum residue annually, as well as gasoline from leaking tanks and oil spills. The elimination of motor use on the river will prevent incorporation of oil and gasoline products and generally enhance water quality of the river.

The potential for localized pollution adjacent to campsites or along tributaries will be eliminated when all human fecal material is removed from the canyon. In the event of an accidental spill of containerized waste into the river, other downstream trips will be notified. If an accidental spill occurs on a beach, the material will be cleaned up.

Waste water from cooking and washing activities in camping situations will continue to be disposed of in the river. The use of soaps and other detergents in the river will continue to be permitted; however, using soaps in the tributaries is and will not be permitted. The amount

of phosphates released to the main stream are probably insignificant. Nevertheless, use of low phosphate soaps is required (CFR 40, Section 120).

The amount of all pollutants added to the river by visitor activities will probably be insignificant due primarily to the high dilution factor related to the volume of water in the river.

Therefore, the above actions will slightly improve, but not significantly change the overall water quality of the river and its tributaries.

#### D. IMPACT ON AIR QUALITY

The present use patterns have a minimal effect on the quality of the air in the Inner Canyon area. The existing impacts result from the production of outboard motor exhaust pollutants and the particulates generated from cooking and recreation fires.

The current use of outboard motors results in the consumption of approximately 25,000 gallons of gasoline per year during the float trips on the Colorado River. The hydrocarbons generated by gasoline combustion will no longer enter the atmosphere when motorized travel is eliminated.

The combustion of wood at present levels has only a slight local and temporary effect on overall air quality along the Colorado River. Reducing the number of fires will improve on this situation.

Local impacts due to odors caused by motor exhaust and gasoline while on the river or at mooring sites will be eliminated when motorized travel is eliminated. Also the noxious odors associated with improperly buried fecal material will no longer impair air quality in beach camping areas.

Pollutants added to the air through river-running activities are local and temporary. Actions of the proposed plan will have a positive effect on air quality of these localized areas, but no measurable effect on overall quality of the air within the Inner Canyon.

#### E. IMPACT ON CULTURAL RESOURCES

The gathering of firewood and the disposal of human waste along the river corridor are two activities that can cause direct destruction of cultural resources. Firewood collecting has become particularly damaging to some of the archeological and historical resources in the canyon. The present use patterns have resulted in such a shortage of firewood at heavy use campsites that the river runners are frequently forced to halt other activities in the early afternoon and specifically gather firewood wherever it is available and haul it by boat to that night's campsite. None of the heavily used campsites have an adequate supply of firewood now. During their firewood foraging activities, the river runners occasionally come in contact with the remains of some previous occupation

(e.g., Hance Cabin, Bert Loper's boat, etc.). The result has been that these structural resources are disappearing. In addition, the gathering of firewood on some of the beach terraces may cause the disturbance of surface archeological remains. The digging of waste disposal holes can also cause serious disturbances to the irreplaceable archeological resources in areas of the canyon where sites are known to be abundant, such as Nankoweap and Unkar, and other locations.

The reduction of and limitations on use of wood fires and the removal of all human waste from the canyon will serve to protect the remaining cultural resources. The deterioration of historic structures due to firewood gathering practices and the potential for digging into an archeological site for a waste dump hole will be eliminated.

Although vandalism results in a certain amount of destruction under existing use patterns, the principal impacts result simply from visitation to the historic and archeological sites. The proposed plan will lengthen the visitor's stay on the river and, therefore, increase day-use visitation of the cultural sites. However, the high-density use patterns and related congestion at attraction sites will be modified, serving to lessen the deterioration of sites caused by crowding and uncontrolled use. Increased annual visitation could accelerate the rate of deterioration of these areas and, without mitigation, could result in the loss of valuable non-renewable resources.

To ensure preservation of cultural resources at the proposed use level, all archeological sites within the river corridor will be evaluated and will receive protective treatment, if needed (stabilization, testing, or excavation). There will be a minor loss of scientific data due to stabilization, testing, or excavation, in that any removal of material from its cultural context reduces the amount of information available for future archeological research (see I. C. 5 for specific sites).

Historic remains within the river corridor will be evaluated for historic significance, and those meeting the criteria for the National Register of Historic Places will be nominated. Eleven historic sites will be preserved through protective devices for stabilization.

Other sites, not immediately adjacent to the Colorado River but easily accessible to river runners and backcountry users that will be investigated include: Hermit Camp, Boucher Camp, and Bat Cave Guano Mine.

Another action that will serve to offset visitor use impacts and reduce deterioration of cultural resources includes the implementation of education/orientation programs for commercial trip leaders and guides and noncommercial river runners.

In summary, both direct and indirect adverse impacts on cultural resources will be reduced through the reduction of firewood collecting, the removal of human waste from the canyon, and the modification of high-density

user levels. Inadvertent harm and deterioration due to greater visitation will be reduced through direct preservation or protection, and interpretation and education. No serious impacts on cultural resources are expected to occur as a result of the proposed actions.

#### F. IMPACT ON VISITOR GROUP CHARACTERISTICS

Under the present use levels, the river-running public represents a select socioeconomic/demographic group. A change in total use levels would not be expected to have any effect on this overall pattern. Similarly, the removal of motorized craft would not significantly affect any one socioeconomic/demographic group utilizing the river between Lees Ferry and Separation canyon (see Section II. N. for discussion). Since both oar and motor trip passengers possess essentially the same education, economic and urban backgrounds plus such characteristics as age, marital status and number of children, the shift from motors to oars will not alter the overall composition of the commercial river-running group.

Motorized traffic and upriver travel will be eliminated from Diamond Creek (Mile 225.6) to Separation Canyon (Mile 239.5), but will be allowed to continue on downstream from Separation Canyon to Grand Wash Cliffs (Mile 227). This will adversely impact those boaters who now make upriver runs in the rapids above Separation Canyon. This will also impact the Hualapai Tribe commercial river-running operation. The Tribe has not run motorized trips between Diamond Creek and Separation for the last two seasons (1977, 1978). They did run motor trips in prior years, and any plan to run motorized trips in future years would be precluded by this decision.

No change is expected in characteristics of the visitor who participates in a recreational activity in the Lower Gorge section of the canyon below Separation Canyon. The people in this part of the canyon come for different experiences than the participants in the upper 240-mile river trip. Present visitors are primarily interested in water-based recreation, the use of powerboats, and the scenery, for short weekends or one-day experiences. It can be assumed that these people will continue to visit the backwaters of Lake Head and will not be affected by proposed management actions above Separation Canyon.

The proposed allocation of use between commercial and noncommercial parties could change the socioeconomic/demographic characteristics of the total river-running population. The research results, summarized below, indicate the potential shift under present use conditions.

The private and commercial groups differ in demographic characteristics, so alterations in the percentage of use allocated to each group would affect the demographic composition of the overall river-running population. If the percentage of private use were increased, more people who are young, male, of slightly lower income, and from less urbanized areas would be running the river. If total number of people remained constant,

an increase in private use would mean a decrease in commercial use, and consequently a decrease in the number of persons with "commercial" characteristics (e.g., older persons, women, etc.). The magnitude of these shifts are not expected to be large, since correlations of trip type with demographic variables are fairly low. For example, a change to 50 percent private, 50 percent commercial would be expected to change the average age of river runners from 32.4 to 30.3. Private users also have more outdoor and river-running experience, so an increase in private use would probably cause an increase in the number of river runners with such experience (Shelby and Nielsen, 1976).

Under the proposed plan, approximately one of every four river runners will be a noncommercial user as compared to one of every 20 under status quo or one of every two as indicated in the above example. Commercial use will increase by a few thousand persons (including those taking partial trips) and noncommercial use will increase by approximately 2,900 persons; overall visitor characteristics are expected to shift slightly, but not to a significant degree.

In summary, the proposed elimination of motors above Separation Canyon and the allocation of use will not alter the overall composition of the river-running groups to any great degree.

#### G. IMPACT ON VISITOR OPTIONS

The removal of motors, the allocation of use, increased use throughout the year, and scheduling will have an effect on the range of options available to the river recreationist.

With the elimination of motorized float trips, park visitors who prefer only motorized travel may forego the river-running experience through the Grand Canyon. Research data obtained during the sociological studies indicates that 98 percent of those on commercial oar trips and 15 percent of those on commercial motor trips prefer to run the river on an oar trip. Of those who had the opportunity to experience both types of travel, approximately 5 percent preferred motorized craft. Assuming this group represents the river-running population, only 566 of the 11,335 people who ran the river in 1979 would be adversely affected by the change from motors to oars. It would have been desirable to repeat the combination trip experiment to strengthen the statistic reliability of the data. However, the information from this research is sufficiently reliable to indicate that when people have had the opportunity to experience both modes of travel the majority will choose oar-powered trips.

There is strong indication that almost all those who have had the opportunity to experience both motor and oar trips prefer oar trips over motor trips. However, most river runners are on their first river trip and do not have the experience of either type of trip. For these people, the choice is limited by what information they can obtain from the concessioner as to relative merits of the two modes of travel. Concessioners

will naturally sponsor the type of watercraft best suited to their operation. People with time constraints and money limitations will generally choose the shorter, less expensive trip. The shorter, less expensive trip at present is the motorized trip. There was some public input to the effect that shorter, less expensive full-length motorized trips should be retained. Those who want this type of trip will be impacted due to its loss under the proposed action. Those who do choose the shorter, less costly trips will not experience a full-length trip.

The elimination of motors in the Lower Gorge from Diamond Creek to Separation Canyon (15 miles) will reduce visitor options, in that motorboat trips down river with the Hualapai will be eliminated, and visitors will have to make that distance in rowing craft. Also visitors will lose the option of up-river runs in the rapids of the Colorado River in Grand Canyon.

However, most of those canyon visitors who come by boat from Lake Head National Recreation Area will be relatively unaffected by this action. Most of the lake boating occurs well below Separation Canyon. Some boaters do go up the canyon as far as the first rapids usually (Mile 237), and their option to do so will be restricted by this action, to only going as far as Separation Canyon (Mile 239.5).

Those users continuing a trip from Lees Ferry past Diamond Creek, or beginning a trip from Diamond Creek, would still have the option of motoring across the lake slackwater below Separation Canyon.

Options involving length of trip and off-season use will differ to some extent from the opportunities available under existing conditions.

The exclusion of motorized craft would lengthen the minimum amount of time required to traverse the Grand Canyon by river from 6 to 11 or 12 days. Motorized trips average 8 days in length, non-motorized trips average 12.5 days in length. The option of a short 6- to 10-day trip through the entire canyon will no longer be available. However, there will be partial trips available beginning or ending at Phantom Ranch. In addition, trips ranging from 1 day to 12 or more days will be possible, but will involve hiking into or out of the canyon or both. Examples are provided below:

<u>Trail In</u>	<u>On River</u>	<u>Trail Out</u>
Hance	1 day	Bright Angel
Kaibab	1 day	Hermit
Kaibab	2-3 days	Tapeats-Thunder River
Tanner	3-4 days	Havasui
Little Colorado	6-8 days	Whitmore Wash
Kaibab	8-10 days	Pierce Ferry

The maximum length of trip will be limited to 18 days in the summer season and 21 days in the winter season. Visitor options in terms of maximum length of stay will remain about the same. Noncommercial parties will forego the opportunity to spend an unlimited amount of time in the canyon during both summer and winter seasons.

Noncommercial passengers will have greatly increased options due to both the increase in user days (from 8 to 30 percent), and the more even dispersal of commercial use during the peak summer months. Some commercial users, on the other hand, will be inconvenienced due to reduced numbers of float trips during the peak months of June, July, and August. However, oar-powered trips allow more time for the visitor to experience the various points of interest within the canyon. Trips of up to 18 days in the summer season and 21 days in the winter season will provide a variety of options for off-river use, including the opportunity to visit more attraction sites or unique canyon features, to hike, and to camp. Average trips of 12 days would provide 5 to 6 additional days for off-river hiking or scenic viewing in the summer. In the winter, up to 10 additional days would be available for off-river use.

Within the portion of the public desirous of a river trip a variety of user interests exist. These segments exist in unequal sizes, and their satisfaction is a function of the type of trip and options offered. Not all people want a long trip, or want to do extensive hiking. Amount and length of stays off river and on river would be factors considered in selection of concessioners. Concessioners will be granted flexibility in adjusting trip length to meet public demand. By choosing companies offering a variety of trips, a wide range of visitor options would be made available.

In summary, the proposed changes will not significantly alter the range of options presently available to the river-running public. Commercial passengers may choose trip lengths ranging from 1 to 18 days, and opportunities for off-river use will be greater. Options for the noncommercial passengers will increase, providing a wider variety of choice. Those river recreationists preferring motorized travel will be adversely affected. The option of a short, speedy trip through the canyon will be denied a small percentage of the river-running public.

#### H. IMPACT ON THE VISITOR EXPERIENCE

Providing a high quality river-running experience is a concern of both concessioners and National Park Service managers. Although the quality of experience is hard to define, there is some general agreement that two major factors have an important effect on the visitor's river trip experience: the amount of use encountered on the river and the kind of trip taken (whether motor or oar). Other important aspects include interpretation and education.

## 1. Contact and Crowding

Elements of the plan that serve to reduce the resource impacts that result from crowding and congestion at attraction sites will also operate to reduce contacts while on the river, and contact and congestion at off-river areas of interest. These include less variable rates of speed due to the removal of motors, the smaller trip size, coupled with restricted launch scheduling.

At present, commercial trips leaving Lees Ferry travel at different speeds and take 6 to 18 days to traverse the canyon. Fast trips, then, may encounter people who left several days before them, while slower trips are passed by those leaving later. A typical river trip during the 1975 or 1976 season met between three or four other trips on the river each day and spent about 40 minutes per day in sight of other parties. By eliminating the use of motors, the speed variable is reduced considerably. This coupled with daily and weekly launch restrictions, is expected to reduce on-river encounters below present contact levels. Trips would also be scheduled in such a manner as to allow an average of approximately 6.25 miles between groups. Overall, contacts on the river and at attraction sites would be within the range preferred by the majority of the river-running public, which is lower than at present (see Section II, N. 4 for visitor preferences). The variables of trip length, time spent at attraction sites, and length of off-river hiking will continue to influence the probability of contact. Although more total boats will be on the river at any one time fewer groups will be involved. Since trips generally travel in groups, there will be fewer intergroup contacts.

Two elements of the proposed plan could increase the probability of higher contact levels--the allocation of noncommercial use and the short trip to or from Phantom Ranch.

Noncommercial river trips spend more time off river and in the canyon than do commercial trips. The average length for noncommercial trips in 1978 was 19 days. The increased number of noncommercial users staying longer within the canyon could influence contact levels. This potential effect is not, however, considered significant. Noncommercial users prefer even less contact than do commercial users, and will tend to avoid crowded areas.

The more even dispersal of use will also offset the contact or crowding potential of increased noncommercial use.

Because non-motorized craft take longer to traverse a given section of the river, the demand for partial trips to or from Phantom Ranch is very likely to increase. Partial trips would increase the overall number of people who are to take river trips. The amount of increased numbers would be difficult to predict at this time. It might seem at first glance that this activity would increase disproportionately, causing

river congestion and greater use of hiking and camping facilities in this major passenger transfer area. However, there are certain built-in and natural limiting factors. Those factors are:

There is a campground limit of 75 people at the Bright Angel Camp at Phantom Ranch. This will limit the number of people who would hike down to the river or out with an overnight stay.

The commercial accommodations at Phantom Ranch have a limited capacity of about 75 people per night which also limits the number of people who could hike in and stay overnight or stay overnight and then hike out.

There is a limit on the number of mules allowed on the Bright Angel Trail which limits the number of people who could ride a mule in or out. This limit will include the additional mules to be provided for river travelers who cannot hike in or out of the canyon.

Most people hiking into or Out from a river trip do so under present conditions in less than a day. In 1978, 3,900 people took partial river trips involving a hike into or out of the canyon. It is expected that the number of people who choose this type of trip will increase in the future by at least 3,000 annually. This increase is not expected to adversely affect contact levels nor create undue congestion or crowding in the Phantom Ranch area. An increase of this amount is not significant when compared to the some 250,000 to 300,000 people who each year hike the South Kaibab and Bright Angel Trails. Also, not all partial trip participants would ingress or egress at Phantom Ranch. Finally, the reduced party size and the smaller number of persons per boat on the oar-powered river trip will decrease off-river congestion and more nearly approximate visitor preferences. The majority of commercial users favored a small party size of 20 persons or less, and 80 percent preferred to run the river with a party of 30 or less. Most visitors also preferred to meet smaller parties on the river and at attraction sites.

In summary, with the more even dispersal of use during a longer season, daily and weekly launch schedules and small party size, the number of contacts per day and the number of persons encountered off river should be reduced. The visitors' river-running experience, in terms of the amount of use encountered on the river, is expected to increase in quality.

The combination of upstream and downstream use in the remaining 37 miles of river corridor would continue, as would the probabilities of contact and congestion. Because the Lower Gorge is adjacent to a recreation area, the use of high-speed motorboats and greater contact levels are accepted as part of the lake experience. However, the transition from the quiet oar trip to the motorized crossing of the lake will adversely

affect the quality of the visitors experience, in that the feeling of wilderness will abruptly end at Separation Canyon.

## 2. Trip Character

The proposal to convert from motorized to oar-powered river craft will significantly affect the type and character of the river trip available to the visitor. Each of the following changes will, to a lesser or greater degree, affect the overall quality of the visitor's experience.

Large motorized craft will be replaced by smaller craft.

There will be more craft per party and fewer people per boat

River guides per party will increase

River parties will spend more time in the canyon

River parties will visit more sites and stay longer off river

Motor noise will be eliminated

The fast, short trip will be eliminated

Research has indicated that non-motorized trips are more pleasing to the visitor (see Section II. N. 4 for discussion). Reasons given suggest that oar travel is seen as more consistent with a natural or wilderness experience. Passengers who had experience with both motor and oar trips preferred the oar trip. They enjoyed the slower pace, could relax; they became more aware of natural sounds in the canyon; and they were able to observe more closely the unique features along the river and more easily ask questions of their guide. Smaller social groupings appear to influence feelings of comfort, friendliness, and camaraderie. On oar trips, the passengers could gain a greater knowledge and appreciation of the canyon.

Other factors that may alter trip character and thereby affect the visitor's experience to a minor degree are season of use and new regulations. The slower oar trip allowed more time at a site, visits to a greater number of attractions, and provided passengers an opportunity to see and explore features of interest at their own pace. Oar passengers showed greater knowledge of the canyon and gained a fuller appreciation of canyon resources.

Clearly, the mode of travel, smaller parties, length of time spent in the canyon and lack of noise contribute to the character of the river trip. This type of trip, in turn, influences the overall human experience which includes social interaction, the learning process, satisfaction, and awareness.

In summary, because the oar trip appears to contribute substantially to the quality of the river-running experience, no significant adverse effects on the visitor experience are anticipated due to the proposed change in trip character. However, disappointment and minor inconveniences may be felt by a small percentage of people due to their preference for a faster more active motorized experience. Also, those visitors who cannot spend the amount of time required to travel the entire river by oar, may choose the half-canyon or other less than full-length trip, but experience disappointment in not seeing the whole canyon. Although the quality of the river trip to or from Phantom Ranch would remain the same, the time restraint felt by the individual could adversely affect his or her river-running experience.

Other factors that may alter trip character and thereby affect the visitor's experience to a minor degree are season of use and new regulations.

Climate and temperature impose varying constraints on river runners throughout the year. For instance, cooler temperatures during the winter months require additional clothing for warmth, and summer thunderstorms on many afternoons during July and August can either bring relief from high temperatures or discomfort if caught in the rain.

The extended river-running season will have both advantages and disadvantages depending upon the month of year and the expectations of individual visitors. The spring and fall months, now underutilized, potentially provide the better trip experience; the temperatures are not extreme, rainfall is rare, and natural elements are of more interest. Spring and fall are the times of natural change: bird migrations, nesting activities, desert floral displays, and bighorn lambing. Adverse effects on the visitor experience can occur when the individual prefers the character of a summer trip, but must choose either late spring or early fall to run the river, due to proposed regulation of trip launches affecting the peak summer months.

Fall and winter river trips will provide excellent opportunities for fishing in connection with river running. Rainbow trout in the 6 to 8 lb range are commonly caught, with larger catches up to 18 lbs. Rainbow trout spawning begins in late September and continues through December during which time fishing is excellent. Fishing remains good through most of the winter.

The winter river trip requires a "hardier outlook" on the part of river travelers choosing this season. Winter trips offer more solitude but colder temperatures. River running in the winter presents additional preparation requirements. Where minimal clothing for summer includes cut-off trousers, bathing suits, and light weight shirts, winter travel will require warm, waterproof clothing and, possibly, wet suits. Additional preparations for warmer sleeping gear are also needed. Constant awareness and remedial action to prevent or correct hypothermia is

necessary. If preparations are made and proper precautions taken, winter trips can be very rewarding and are no more difficult or dangerous than other winter sport activities. Night temperatures are usually below freezing during only December and January and daytime temperatures are usually pleasant.

The total river-running experience for most visitors will not be adversely affected by the character of the trip during any particular season. In general, those preferring the summer season trip would be accommodated as would those favoring the winter trip. The overwhelming experience of the canyon itself usually far outweighs the minor inconveniences brought about by climate or temperature.

Similarly, new regulations and restrictions could cause minor inconvenience, but not to the degree that the visitor's experience would be adversely affected. As implied in the previous discussion, the regulation of daily and weekly trip launches reduces the number of persons allowed on the river during the months of highest demand. Some adjustment in terms of selecting a day of the week or month in the season for trip departure will be unavoidable (see Section II, Tables 17 and 18). In 1978, approximately 2,700 persons per month leave Lees Ferry during June, July, and August. The proposed trip scheduling will permit only about 2,000 per month during these 3 months; therefore, 2,100 persons or 18 percent of the total number of visitors leaving Lees Ferry (11,895) during the summer season must choose other months for their trip departure.

The inconvenience of carrying in summer firewood and the carryout of ash could affect some people, however, allowing fires for esthetic purposes should mitigate this inconvenience.

The regulation that human solid waste material is taken from the canyon will affect noncommercial users more than commercial passengers, since waste disposal is already an accepted part of the commercial operation. Private river parties must make their own arrangements for proper waste disposal equipment. Although technically simple, carrying and hauling out wastes could be considered a hindrance by some river runners.

### 3. Interpretation and Education

As indicated previously, the length of trip, party size, and motor noise influence the type and amount of knowledge gained by the visitor. The interpretive value of the river trip was increased significantly for the people who took oar trips over those who took motorized trips. Communication between 1 guide and 5 people in the relative quiet of the canyon is significantly improved over communication between 1 guide and 15 people masked by motor noise.

The average trip length of 12 days and reduced speed, as well as reduced party size, and an average passenger to guide ration of 1 to 5 will serve to increase interpretive potential. The removal of motor noise

should increase the information available to visitors, and will foster guide/passenger relations and communications, an important factor in their perception of the canyon.

The interpretive value of the river trip has a direct bearing on the quality of the visitor's experience. Interpretation not only fulfills the desire of people to know about various geological, natural, or historical features, but serves to educate an individual unfamiliar with river-running conditions within the canyon. The reason for safety regulations or visitor restrictions must be understood before they can be readily accepted. Visitors who feel they have learned a great deal about the canyon and have gained an understanding of river-running procedures in relation to safety, sanitation and resource protection, tend to give their trip experience a high rating.

Pre-trip education of commercial trip leaders and guides and noncommercial trip leaders is one of the most important factors influencing the interpretive value of the river trip for both commercial and noncommercial passengers. The proposal to expand the orientation/information/ interpretive training program for commercial guides, and to develop a pre-trip program of a similar nature for all noncommercial trip leaders, is viewed as a positive measure that can only increase the quality of the river-running experience. Some noncommercial trip leaders may, at first, feel inconvenienced having to attend a program before floating the river, but the requirement should enhance rather than impair the quality of their trip.

#### 4. Esthetics

The plan contains elements that will improve the esthetic aspects of the canyon. Disposal of human wastes outside the canyon improve the quality of the visitor's experience by removing a current source of esthetic displeasure, the noxious visual and olfactory impacts associated with improper waste burial sites. In addition, potential health hazards are removed by discontinuing the burial of wastes in the beaches.

Restrictions on the use of fire and proper disposal of charcoal residues prevent the "bathtub" effect on beach areas. Darkened patches of beach sand or rings of charcoal created by wave action will no longer impair the visual quality of the beaches.

Elimination of motorized watercraft will reduce noise throughout the river corridor. Motor noise is primarily disturbing to the river-running visitors, but also adversely impacts other backcountry users hiking or camping in areas adjacent to the river. Research has shown that a large portion of river users (44 percent) felt their wilderness experience would improve if motors were banned.

The only development proposed by the plan that could impair the esthetic quality of the canyon or that of lands adjacent to the river for the

visitor is trail construction. New trail alignments that require minor cut and fill, erosion control measures, and other devices to direct runoff could be considered intrusions in natural areas. The proposed single trails to attraction sites will replace 12 to 15 multiple trails in some areas. After obliteration of old trail scars and restoration, the appearance of such areas will be considerably improved.

## 5. Safety

There are no actions in the plan that would adversely affect the health and safety of the river-running public. The removal of motorized craft will not affect the safety of the river trip. Table 22, (Section II.N. 4. c.) indicates that non-motorized craft have fewer accidents requiring NPS evacuation, but this difference is not statistically significant.

Research indicates that noise levels of motors near boat pilots (83 to 89 dba) approach the national health standard's maximum allowable limits (90 dba). There exists the potential for permanent hearing loss for guides on motorized craft. Motor noise levels may also adversely affect the operator's performance resulting in potential safety hazards. The removal of motorized craft will eliminate the possibility of hearing injuries and provide a potentially safer trip for the visitor. However, during the motor phase out period, concessioners and boatmen involved with motorized craft should be aware of and take steps to mitigate impacts of motor noise on boatmen hearing and passenger safety.

The elimination of wood fires during the summer season reduces the number of injuries (burns) associated with improper use or supervision of fires.

Existing regulations concerning sanitation, food preparation, water use, and boating safety will continue to be in effect, with increased emphasis.

Other than cold weather from mid-November to mid-February, there are no added safety problems during the winter months. Water flow during winter is sometimes lower than summer, but is adequate for oar trips.

Powerboating accidents will continue in the Lower Gorge area due to the retention of powerboating and up-river travel from Lake Head.

## I. ECONOMIC IMPACT

### 1. Visitors

Overall trip costs are not expected to increase significantly due to the implementation of the river management plan. The range of prices offered the visitor will probably remain the same except for inflationary increases, although some increases depending upon the commercial company may be expected, due to changes in the type of trip offered and status of the economy at any given time.

At present, there is little difference between the average cost of an oar-powered trip and a motorized trip. For the 1979 season, river trips are available from 1 day at \$125 to 22 days at \$1,075. The highest priced trip is an 18-day oar trip at \$1,350. The average cost of a full-length 12-day oar-powered trip to at least Diamond Creek for 1979 is \$649 compared to an 8-day motor-powered trip to at least Diamond Creek is \$571. The difference between these two average costs is \$78 with the oar trip providing 4 more days on the river for this price. It is expected that costs for oar powered trips could increase from \$100 to \$150 for full length trips.

Not all visitors want the same experience, nor do all people want to pay the same for their canyon experience. The allocation of user days among concessioners will provide for a variety of prices from which the visitor may choose. Based upon the average socioeconomic background of the commercial user and the demand for higher priced trips, increased trip costs would not significantly affect this segment of the river-running population.

The noncommercial river runner will be affected by the new regulations. The cost of the private trip will increase due to equipment required for sanitation and cooking. These costs are not expected to cause undue financial hardship for this river-running group.

## 2. River Guides

Most of the current concessioners could accommodate an increase in use by simply extending their river-running season. This would affect the guides by providing approximately 6 to 7 months work rather than 4 to 5.

River guides operating and preferring motorized float trips may forego job opportunities when concessioners convert to oar-powered craft. The extended season and longer oar trips may increase income for some river guides. Opportunities for employment should be greater due to the increased passenger/guide ratio.

## 3. Other interests

The Hualapai Tribe operates river-running trips from Diamond Creek to Pierce Ferry. During the past couple of years (1977, 1978) their trips have been rowing to Separation Canyon and motor from Separation Canyon to Pierce Ferry. For their own commercial operation, they will have to continue using oar-powered equipment as far as Separation Canyon as they have done for the past couple of years. They then would have the option to continue rowing across Lake Mead or carry a motor to be put on and used from Separation Canyon to Pierce Ferry. The cost is not expected to create significant economic problems for this operation, since rowing craft is already used from Diamond Creek to Separation Canyon.

A positive economic effect, on the other hand, will likely occur at Diamond Creek. Removal of motors is expected to increase the revenues being paid to the Hualapai Tribe for the use of their road from Diamond Creek to Peach Springs because more companies will likely choose to take their boats out at that point. However, future use may be affected by the fees set by the Tribe and could drop if the fee increases significantly. Some concessioners have indicated that they would take out at Pierce Ferry rather than Diamond Creek if the fees are too high.

#### 4. Regional Economy and Concessioners

The river-running industry makes up such a small portion of the local and regional economies that increasing the total visitor use levels and allowing increased commercial allotments would not have any appreciable effect. The one exception to this would be Kane County, Utah (Kanab), where the river-running industry contributes measurably to the local economy. But, even in this case it is not a significant factor.

#### 5. Park Management

Management costs will increase considerably due to personnel needed for additional patrols, monitoring, and orientation/education/training programs. If additional personnel, equipment, and funding are not provided to properly execute the management plan, negative effects can be expected due to lack of effective orientation provided at Lees Ferry and lack of resource protection, regulation, and training to be provided by the Grand Canyon staff.

### J. OUTSIDE INFLUENCES

#### 1. Noise

Unnatural sounds will continue to intrude upon the quiet of the canyon and create a disturbance for many users. Noises from low-flying aircraft, helicopters, and subsonic and supersonic airplanes are superimposed upon and mask the natural sounds. The noise and general intrusion of helicopters being used for takeouts in the Lava Falls area from the Hualapai Tribal lands side of the river will continue. However, location and scheduling of this intrusive activity should minimize its impact on other river runners. Existing noise intrusions from other aircraft overflights which adversely affect the visitor experience will continue until research is completed and the control or scheduling plan is implemented. Further study and intensive coordination with commercial and noncommercial aircraft operators on this complex parkwide problem will be necessary before noise impact can be reduced.

#### 2. Water Flow

The release of water from Glen Canyon Dam will continue to affect river-running activities in the canyon. Water flow fluctuates daily depending

largely upon power demands in the region. When power demands are low, generally minimum flows are released to conserve as much water as possible; when power is needed, high volumes of water are usually released into the canyon (refer to Section II. A. 2 for previous discussions). Low flows are a serious problem. For example, in April 1977, approximately 90 boaters on eight float trips were stranded in the Marble Canyon section due to low water flows of about 1,000 cubic feet per second. The National Park Service and the Bureau of Reclamation worked together for additional water releases (approximately 6,000 cfs) to allow the stranded boaters to move down river to Phantom Ranch. Food had to be flown to passengers of one trip that had been stranded for 4 days. One boat, a 22-foot row boat, was not able to travel the low water flows and was helicoptered from the canyon at Phantom Ranch. Extremely low water flows make river running virtually impossible, except for trips with small rowing boats (18' or smaller). The April incident caused 31 commercial trips to be cancelled, and approximately 135 additional trips to be eliminated on the basis of low water flow for May and early June 1977.

During times of low precipitation, and especially during periods of drought, the following effects can be anticipated:

- River passengers may become stranded, depending upon their location in the canyon, the amount of water released during the week, and size of water craft.
- Oar-powered boats will encounter less problems during low water releases than do larger motorized trips at present.
- During minimal flows, only the small oar craft can be expected to negotiate the canyon.
- Trip cancellations and subsequent economic loss to the concessioners can be expected, but will be less when large motor trips are eliminated.
- Potential visitors will be disappointed if their trips are cancelled.

During periods of high precipitation or peak power demand, excess water may be released, resulting in the following effects:

- High flows that will not adversely affect the river-running industry.
- High flows that will allow the large boats to negotiate the canyon.
- Rapids can become hazardous, especially for inexperienced river runners, and accidents can increase.

High flows that, coupled with daily fluctuation, will continue to erode beach sands more rapidly than more stable or consistent flows.

Adjustments in scheduling and management of river trips will probably continue for both the National Park Service and river runners due to the regulation of Glen Canyon Dam. Efforts will be made to coordinate water releases for the benefit of the river-running public, but it is understood that the purpose of Glen Canyon Dam is to satisfy water and power demands of the region's growing population.